



# Ensuring Conformance to ITS Standards

**A Study Conducted for the ITS Joint Program Office  
of the U.S. Department of Transportation**

**January 22, 2001**

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## Executive Summary

At U.S. DOT's request, the Intelligent Transportation Society of America (ITS America) conducted a study of "ITS Standards Rulemaking in a Time of Rapid Technology Change." This study responded to U.S. DOT concerns regarding its Congressionally mandated charge to ensure that the ITS projects using funds from the Highway Trust Fund conform to relevant and applicable standards and protocols<sup>1</sup>. U.S. DOT was particularly concerned that traditional rulemaking would not be an effective mechanism for assuring such conformance, due to the lengthy process associated with rulemaking and the rapid pace at which ITS technology is emerging, evolving, and being overtaken by other technologies.

The purpose of the study was (1) to explore how rulemaking could be most sensibly applied in the context of ITS projects, and (2) to explore alternatives to rulemaking which could achieve the conformance goals with less complex machinery in shorter timeframes.

A wide cross-section of relevant stakeholders, including users, system integrators, manufacturers, and industry experts, was invited to provide inputs to this study through a telephone meeting and an in-person Brainstorming Session. These stakeholders were also invited to participate in the review and refinement of initial drafts of this paper. This paper discusses the background for the study, the process followed, and the conclusions reached.

The main conclusion was that U.S. DOT should only promote conformance to a standard, via rulemaking or otherwise, where it has determined that the standard will significantly enhance system lifecycle economics and/or national ITS interoperability. U.S. DOT should assure in advance that any such standard is sound, robust, and proven in practice, and that appropriate mechanisms are in place to keep it maintained and up to date. Particular care needs to be exercised where standards are based on, or make use of, rapidly changing technology, especially when the technology originates from other industries.

An equally important conclusion was that standards conformance could be ensured by mechanisms other than rulemaking. Where an alternate is available, stakeholders generally regard its use as preferable to rulemaking as a mechanism for ensuring conformance. Stakeholders agreed that the most appealing alternative approach is an energetic program of outreach and education that demonstrates the tangible benefits of conformance to particular standards.

Specific conclusions and recommendations, discussed in greater detail in the final section of this report, were:

1. Having U.S. DOT ensure conformance to selected ITS standards is potentially valuable and helpful, as well as required by TEA-21. Such standards should serve clear national interests

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<sup>1</sup> For simplicity, this paper uses the term "standards" to encompass the entire complement of standards and protocols

(i.e., significantly enhance system lifecycle economics and/or national ITS interoperability) and meet stringent requirements for maturity and robustness.

2. Stakeholders prefer other mechanisms to rulemaking, most notably, an energetic program of outreach and education for selected ITS standards.
3. Carefully promoted early adoption by one or two stakeholders is an important step in qualifying standards for conformance encouragement. Assuring appropriate feedback from early adopters is crucial to this process.
4. Rulemaking is still necessary or useful in some circumstances, notably where incentives are not working or to transform general adoption to universal adoption.
5. The standards development lifecycle can be improved through greater attention to recommended practices, use of applicable standards and practices from other industries, by assuring an effective maintenance process, and by helping to keep the cost of publication and distribution moderate.
6. For a focused subset of ITS standards, additional support for validation, consistency assurance, and product compliance testing would be very valuable. Successful testing would itself help to encourage conformance to these standards, by reducing the risk of their adoption.

## Introduction

### Background

The Transportation Equity Act for the 21st Century (TEA-21)<sup>2</sup>, directs the U.S. Department of Transportation (U.S. DOT) to:

“...ensure that intelligent transportation system projects carried out using funds made available from the Highway Trust Fund, including funds made available under this subtitle to deploy intelligent transportation system technologies, conform to the national architecture, applicable standards or provisional standards, and protocols...”<sup>3</sup>

In the ITS context, the presumption is that these standards will primarily relate to the deployment of ITS infrastructure, given the tie-in to Highway Trust Funds. The primary purpose of ensuring conformance to such standards is to see that Highway Trust Funds are spent wisely: to promote interoperability, sound procurement practices, sensible system lifecycle economics, and a competitive marketplace.

The traditional mechanism to ensure that projects conform to particular requirements is Federal Rulemaking. However, U.S. DOT recognized that ITS technology is evolving rapidly and that rulemaking is an intrinsically lengthy process, typically taking at least 12-18 months. U.S. DOT did not want rulemaking to have the effect of mandating obsolete technology/approaches or of unnecessarily tying the hands of deploying agencies and system integrators in the face of new and innovative technology.

Therefore, the ITS Joint Program Office of U.S. DOT asked ITS America to explore the issue of “ITS Standards Rulemaking in a Time of Rapid Technology Change.” The primary question to be pursued was not how to speed up rulemaking (whose overall course is dictated by law), but to concentrate on: (1) what alternatives to formal rulemaking could produce equally effective results, but more quickly and with less contention, (2) where no practical alternatives exist to rulemaking, which standards are the right kinds of targets for rulemaking and of these, which will be most resilient to change, and (3) what other things might be suitable rulemaking targets. This study was led by Mr. Richard Weiland, a standards consultant to ITS America and U.S. DOT, and by Ms. Dawn Hardesty, ITS America’s Director of Architecture and Standards.

### Structure of the Study

The study consisted of four major parts:

- 1. Initial meeting with U.S. DOT representatives.** The primary purpose of the meeting was to set project goals, give the study leaders a better understanding of the rulemaking

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<sup>2</sup> Specifically, Part C: The Intelligent Transportation Systems Act of 1998

<sup>3</sup> Section 5206(e)

process, and to identify a preliminary list of stakeholders to participate in the study. Stakeholders were primarily to be representatives of:

- State and local agencies
- Manufacturers and vendors of infrastructure-related products
- System integrators

Invitations would also be issued to a small number of technology and policy experts in the area of ITS standards development.

Study leaders prepared a short background paper from the results of the meeting, including an initial cut on the questions to be addressed. Suggestions on stakeholders to be included were also very kindly provided by Ed Seymour (Texas Transportation Institute) and Bo Strickland (AASHTO).

2. **Teleconference with initial stakeholder group.** A teleconference was held on the afternoon of September 7, 2000 with an initial core group of stakeholders. The meeting had two primary goals: to review and refine the list of questions to be addressed by the study (and generally do a sanity check on the study's intentions), and to gather additional suggestions for stakeholder participants. As a result of this teleconference, study leaders refined the background paper and the list of study questions, and issued an invitation to an enlarged stakeholder group to participate in a 1-day Brainstorming Session.
3. **Brainstorming Session with enlarged stakeholder group.** On October 12, 2000, a full-day stakeholders meeting was conducted at ITS America's offices. The purpose of this Brainstorming Session was to consider and respond to the list of questions that was generated in previous project steps and to develop guidance to U.S. DOT on the most appropriate and productive course of action for ensuring conformance to ITS standards. The meeting was characterized as a "brainstorming session" to encourage creative thinking and responses in a situation where "business as usual" was not regarded as sufficient. The study questions were addressed fairly systematically, but as might be expected, responses and suggestions did not always fall strictly within the structure of the questions.
4. **Development and review of study report.** Study leaders prepared a draft report based on participant input. The draft report was reviewed by Brainstorming Session participants and selected other stakeholders. *[The revised report will be circulated for a final review and then delivered to U.S. DOT.]*

## Discussion of Stakeholder Inputs to Study Questions

This section recaps the discussion that was provoked by the study questions presented to stakeholders at the October 12, 2000 Brainstorming Session. Discussion which arose in the context of one question sometimes turned out to be more relevant to another question, and has been moved to follow that question. The discussion does not always constitute a traditional narrative, since multiple, sometimes conflicting viewpoints were presented. A digest of conclusions and recommendations appears in the next section.

**Question 1 - Goals.** The stated goal of ITS standards rulemaking is to promote interoperability and to minimize overall lifecycle costs for ITS infrastructure, by requiring the use of particular standards. How should this understanding be refined? Can this goal reasonably be achieved through ITS standards rulemaking? Is it the right way to achieve this goal?

### Discussion:

Stakeholders were quick to separate the goals of rulemaking from the more general goal of ensuring conformance to appropriate ITS standards. Generally, stakeholders agreed that there was a federal interest in assuring standards conformance where the widespread adoption of the relevant standards would promote ITS interoperability and help to contain system lifecycle costs.

In addition to national interoperability, in which U.S. DOT may have more of a stake than state and local agencies, stakeholders expressed interest in achieving regional interoperability and device interchangeability. Regional interoperability amounts to getting various centers talking to each other via computer-to-computer communications. Stakeholders expressed the desire for more existing “off-the-shelf” solutions that could be applied to their problems without great risk. Stakeholders want a competitive marketplace for the procurement of ITS equipment, and they recognize that good, well tested standards are essential to the ability to buy devices from different manufacturers that can be used interchangeably. It was noted that such interchangeability is easier to achieve with devices than with software.

However, even given standards where appropriate interests exists, stakeholders felt that rulemaking would be appropriate only if (1) no other incentives were reasonably available to ensure conformance; (2) no clear progress toward adoption of these standards was being made, absent rulemaking; and (3) there was a basis for federal influence (e.g., the threat to withhold Highway Trust Funds). Stakeholders felt that rulemaking was not appropriate for local or operations-oriented issues.

In addition, stakeholders felt that for a standard to be a candidate for rulemaking or other conformance encouragement by U.S. DOT, it should be appropriately mature, stable, well-validated, and clearly ready for wide-spread adoption and deployment.

Some stakeholders believed that at present, no ITS standards meet all these criteria and that the time is not yet ripe for ITS standards rulemaking. Stakeholders agreed that it was necessary for U.S. DOT to be responsive to TEA-21 directives, but not necessary to rush into rulemaking. Stakeholders suggested that DOT create and present Congress with its guidelines for ITS standards rulemaking, possibly including the conclusion that, at the present state of the industry, rulemaking is premature, and that other avenues for promoting and ensuring conformance will be more productive, at least in the short and medium term.

In particular, it would be helpful for U.S. DOT to focus some additional spending on validating standards and encouraging their adoption through outreach and education, even at the expense of funding support for the development of new standards.

**Question 2 - Alternative Processes.** Are there *alternative processes* to rulemaking that can achieve the same objective (i.e., widespread adoption of relevant standards that will promote interoperability and minimize lifecycle costs), but in less time or with less machinery?

**Discussion:**

One stakeholder observed: “Rulemaking is a stick. What are the carrots?” The general theme of this discussion was to encourage public agencies to adopt standards by appealing to their enlightened self-interest. That is, if adopting standards really would lead to greater interoperability and lower system lifecycle costs, then it should be possible to encourage adoption, even ensure it, by making these benefits clear and by reducing or eliminating the risk of adopting conforming technology.

Stakeholders broadly bought into the concept of providing targeted incentives to early adopters of key standards. The first objective of these incentives would be to encourage early deployers of standardized technology to provide feedback to the industry. This implies federally funded incentives expressly for incorporating the requirement into deployment contracts that lessons learned be reported. A secondary objective of incentives would be to defray part of the cost of retrofitting deployed technology if the standards and products have to be updated or upgraded based on lessons learned.

The lessons learned have two target audiences. To the extent they reveal problems with standards or technology implementations, they can provide guidance on how to make timely adjustments and improvements. To the extent they illustrate that standards and technology are working effectively, they can serve as a basis for educating other jurisdictions on the benefits of adopting standards and standardized technology, thus encouraging wider adoption. U.S. DOT has a clear role in translating the positive lessons learned into education and outreach materials. Such education, increasingly based on real-world experience, will be of value to buyers and to users. Stakeholders emphasized that education must not stop at explaining the details of technology. It must focus on benefits and help “sell” adopting standards. The inevitable “horror stories” need to be proactively balanced with success stories.



Stakeholders also observed that if U.S. DOT focuses on putting effort and time into the creation of “good” standards whose adoption provides demonstrable value to users and buyers, conformance will take care of itself, and rulemaking will largely be unnecessary.

**Question 3 - Appropriate Standards.** What kinds of standards are most appropriate for rulemaking (or, more generally, for U.S. DOT to provide encouragement for adoption?)

**Discussion:**

Stakeholders began by observing that a long-term perspective was needed for properly addressing this question. They noted that, in the ITS world, standards have not so far been short-term cost savers. The competition which will drive down prices has not yet had an opportunity to establish itself, and new, standardized products are early in their price learning curve (i.e., they are potentially more expensive, at present, than existing pre-standardized products). In addition, introducing one standardized product or system may have the effect of obsoleting adjoining products and systems earlier than otherwise. As a result, adopters of standardized products and systems, especially early adopters, may end up paying higher initial prices. One stakeholder also noted that a variety of technical and political considerations besides pure cost issues will affect procurement decisions.

Stakeholders observed that, in general, standards get developed via one of two very different processes:

1. By distilling existing technology and practice, or
2. By anticipating and trying to guide technology development

Most ITS standards fall into the second category. This increases the risk for early adopters, since the standardized technology is often not mature.

Since U.S. DOT wants to promote the adoption of standards, it needs to help moderate the cost and risk of being an early adopter. This doesn't necessarily mean subsidizing adoption. Early adopters are typically willing to bear some additional cost to be on the leading edge. However, as previously observed, U.S. DOT could usefully defray the cost of thorough reporting on lessons learned. In addition, while early adopters are willing to bear some additional costs, they would like some assurance that they are not going to be made to look foolish by their early adoption. Stakeholders reiterated their earlier position that U.S. DOT needs to assure that the standards it promotes are mature, well-tested, and robust, and proven in real-world deployment. The need for some tweaking is certainly tolerable, but standards which turn out in practice to be major financial or political disasters are not.

Stakeholders cautioned U.S. DOT against too-hard selling, which may have the effect of driving agencies away from ITS. Stakeholders encouraged the identification and calm communication of clear, demonstrated benefits, especially those that are derived from the real-world experience of early adopters.

Stakeholders noted that Advanced Driver Assistance Systems (ADAS) add a whole different dimension to standards adoption. One scenario is that the private sector will be the direct link for providing all the external information that vehicles need to support collision avoidance, stability control, etc. However, if this is slow in coming, or if it appears that the public sector will take a more active role in providing this information directly to vehicles, then issues of consistency arise as vehicles pass from one jurisdiction to another. There may be other instances as well in which the content and delivery of data flows defined by the National ITS Architecture need to be widely consistent in order to provide an economic basis for bringing user services to market. Rulemaking may be needed to assure consistency and to encourage the deployment of relevant user services. After the chicken-and-egg dilemma is cracked, regulation can back off in favor of private sector solutions.

Finally, standards relating to safety in the vehicle, including the management of driver workload, may require rulemaking to assure that safety benefits are maximized. By helping to circumscribe and crystallize product liability issues, rulemaking may also encourage wider and more rapid deployment of standardized, safety-enhancing products and practices.

**Question 4 - Alternative Targets.** What alternative *targets* are there for rulemaking (or other encouragement to adopt from U.S. DOT) are there besides industry consensus standards (e.g., consortium-based specifications)? What are the relative advantages and disadvantages of these targets vs. industry consensus standards?

**Discussion:**

Stakeholders agreed that consortium-based specifications would sometimes be good targets to which conformance could be encouraged. There was some opinion that such specifications should be subjected to the same tests as standards for maturity, validity, and robustness prior to any formal encouragement to adopt. Some stakeholders also observed that consortium specifications can be much more readily encouraged through alternatives to rulemaking (incentives to early adoption, lessons learned, education on benefits, etc.).

Stakeholders were also enthusiastic about the better use of recommended practices as an alternative or supplement to standards.<sup>4</sup> Because they tend to be less prescriptive than formal standards, recommended practices can sometimes be developed more quickly. In addition, a recommended practice could specify the use an existing standard or a family of standards, serving as an alternative mechanism to rulemaking for encouraging adoption and conformance.

Stakeholders recommended that applicable standards from other industries be promoted within ITS to avoid reinventing wheels. However, doing this sensibly requires a systematic exploration of what's available. This should include looks at local *de facto* approaches that

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<sup>4</sup> It was pointed out that some SDOs regard recommended practices simply to be a type of standard, typically a middle road between fully normative standards on the one hand, and information reports on the other. Although recommended practices will be less prescriptive than standards, they are subject to the same rules for open development and consensus approval.

appear to work and which could be transformed into “best practices” without the need for rulemaking. It would be helpful to create a central clearinghouse of these standards and local practices, to avoid the need for each jurisdiction to do the exploration independently.

**Question 5 - Acceleration/Funding.** What can U.S. DOT do to get the standards (etc.) which are candidates for conformance rulemaking (or other encouragement to adopt) completed as rapidly and as soundly as possible? In general, how should U.S. DOT be spending its standards budget?

**Discussion:**

Stakeholders took note of an observation in a recent study of the ITS standards program, conducted by the National Academy of Science for U.S. DOT. This study concluded that the traditional SDO business model for publishing standards doesn't work very well for the infrastructure side of ITS, due to the relatively small size of the market. There is a need, nonetheless, to get standards out into view quickly, for example, via the web. This process needs to be controlled, so that products and systems are not built based on preliminary versions of standards. DOT could help bridge the economic gap at SDOs, so that getting standards completed and promulgated doesn't depend on selling copies of the standards.

In the ITS arena, progress in getting standards approved and published has sometimes been slowed due to ownership by multiple SDOs. U.S. DOT could help establish fair ground rules to short circuit this delay.

There is a real need to get the first adopter or two online fast so that testing can be done, fixes made, and best practices evolved. While it is not a good idea to have a lot of early adopters – too much retrofitting might be required – a couple are needed. Stakeholders suggested that a good use of U.S. DOT funds would be to make this happen.

Some SDOs are already exploring mechanisms for accelerating their internal processes for standards development (e.g., web delivery, teleconferencing, real-time editing, online balloting, institutionalizing the process of continuous improvement). Although it requires careful configuration management, stakeholders felt that more SDOs should do this and that U.S. DOT could provide some incentives to make it happen.

Stakeholders also identified an industry culture issue: the problem that many customer organizations have in being charged for copies of standards for which they had a major development role. Some SDOs, ECMA for example, do not charge for their standards. Membership fees cover costs to make sure that standards are as widely distributed and used as possible.

Stakeholders had the following list of suggestions for U.S. DOT to spend its standards budget:

- a. Fund selected early adopters to provide feedback and lessons learned on standards
- b. Upgrade standards based on early experience

- c. Selectively subsidize the cost of standards validation (does the standard meet its requirements?) and verification (is the standard practicably implementable?)
- d. Help assure that adjoining/interacting standards from various sources actually work effectively together
- e. Support compliance testing (including test planning and execution, and the development of analyzers and simulators)
- f. Conduct education and outreach to motivate the use of standards, provide end users with tools to write procurement specs and to test/install/integrate the standardized products acquired
- g. Fund and support the development of recommended practices as well as formal standards
- h. Fund a clearinghouse operation for potentially applicable standards, including those developed by other industries
- i. Support the maintenance of standards, so they are kept up to date. Insist that SDOs include maintenance provisions for their key standards, especially those that are developed with U.S. DOT funding
- j. Encourage new mechanisms for the expedited publication and distribution of standards by SDOs
- k. Put more resources on fewer standards
- l. Help defray the cost of making published standards available to their users

## Conclusions and Recommendations

- 1. Having U.S. DOT ensure conformance to selected ITS standards is potentially valuable and helpful, as well as required by TEA-21. Such standards should serve clear national interests and meet stringent requirements for maturity and robustness before being promoted by U.S. DOT**

Stakeholders recognized U.S. DOT's obligation to ensure conformance to applicable ITS standards. Beyond U.S. DOT's need to comply with the language of TEA-21, stakeholders broadly recognized the value that can be achieved through the widespread adoption of good, relevant standards. Adoption of such standards can enable and enhance interoperability and can help to contain system lifecycle costs. Stakeholders were emphatic that U.S. DOT should only encourage or require conformance to a standard where a clear federal interest is served.

Stakeholders articulated a number of criteria that a standard should meet before being considered for any form of conformance encouragement by U.S. DOT. In addition to serving a clear federal interest, candidate standards should be demonstrated to be sound, robust, and proven in practice. Appropriate mechanisms need to be in place to keep the standard maintained and up to date. A reviewer noted that this recommendation has good antecedents in the Interstate Highway Program, in which FHWA worked with AASHTO and other national organizations to ensure that required highway and bridge design and construction standards were sound, robust, proven in practice, and properly maintained.

- 2. Stakeholders prefer other mechanisms to rulemaking, most notably, an energetic program of outreach and education for selected ITS standards.**

Stakeholders from both the public and private sectors were clear in their lack of enthusiasm for rulemaking as the primary mechanism for ensuring conformance to relevant ITS standards. Stakeholders argued that if particular ITS standards manifestly produced tangible benefits, then widespread adoption could be ensured through a program of outreach and education. Such a program would probably be cheaper, quicker, and far less contentious than formal rulemaking. Outreach should include tools and processes to aid in procurement, evaluation, and deployment. A reviewer noted that a successful historical example of this approach occurred in the 1980s when FHWA and AASHTO worked together to encourage the states to initiate a formal statewide pavement management system. This included aggressive outreach programs with case studies and illustrations of life cycle costs and savings which made compelling arguments that most states willingly adopted.

- 3. Carefully promoted early adoption by one or two stakeholders is an important step in qualifying standards for conformance encouragement. Assuring appropriate feedback from early adopters is crucial to this process.**

There was a significant stakeholder consensus that an early adoption program would help to assure the viability and robustness of standards to which conformance would be widely

encouraged or universally required. Stakeholders recommended that one or two early adopters be identified (or sought) and that incentives be provided to these early adopters to incorporate feedback mechanisms in their deployment processes. The lessons learned from early adoption could then be used to refine and improve the standards and standardized technology prior to a broad industry investment. A reviewer noted a successful precedent in the Strategic Highway Research Program (SHRP) which chose and rewarded early adopters of new pavement designs.

Where early adoption is successful, the feedback could become part of the outreach and education effort. If early adoption activities revealed that significant changes are needed to standards and technology, U.S. DOT could provide some funds to help defray the early adopters' cost to retrofit and redeploy. In some cases, it is recognized that early adoption may have to proceed in more than one wave, prior to wide industry deployment.

**4. Rulemaking is still necessary or useful in some circumstances, notably where incentives are not working or to transform general adoption to universal adoption.**

Rulemaking can be reserved for instances in which the overall public benefits do not necessarily align well with the costs incurred by individual implementing jurisdictions and in which other incentives do not produce the desired level of adoption. Rulemaking could also be used, following general voluntary adoption, to get straggling jurisdictions into compliance. Some stakeholders also observed that the existence of a rule could make securing local funding for the related program easier.

**5. The standards development lifecycle can be improved through greater attention to recommended practices, use of applicable standards and practices from other industries, by assuring an effective maintenance process, and by helping to keep the cost of publication and distribution moderate.**

Stakeholders made a number of recommendations related to the process of standards development. The first was to put a greater emphasis on the development of recommended practices that would provide hands-on guidance to deployers. In some cases, recommended practices could draw on and specify the use of standards both from within and, as applicable, from outside of the ITS industry. This process could itself be greatly assisted by the development of a clearinghouse, funded by U.S. DOT, for ITS-relevant standards and practices. A reviewer cited "McTrans" as a good example of a clearinghouse. It was established by FHWA in the 1980s at the University of Florida to track transportation software. After three years of FHWA funding, McTrans became self-supporting.

Stakeholders emphasized the importance of keeping standards well-maintained, especially in a rapidly changing field like ITS and especially if conformance to standards was being federally encouraged or mandated.

Stakeholders also recommended that U.S. DOT work with the SDOs and provide incentives for them to find procedural and economic means to expedite the completion, publication, and dissemination of standards.

- 6. For a focused subset of standards, additional support for validation, consistency assurance, and product compliance testing would be very valuable. Successful testing would itself help to encourage conformance to these standards, by reducing the risk of their adoption.**

Stakeholders recommended a series of program activities to help assure that selected standards were appropriately tested and ready to be successfully adopted. These included:

- Selectively subsidizing the cost of standards validation (i.e., determining that the standard meets its requirements) and verification (i.e., determining that the standard is practicably implementable)
- Assuring that adjoining/interacting standards from various sources work effectively together
- Supporting the development of a product compliance testing environment, including the development of analyzers and simulators

A reviewer of this paper noted that during recent ITS Outreach Training conducted in Washington, participants expressed concern relative to the status of the NTCIP exerciser. ... It would seem to make sense that the FHWA/US DOT assume a leadership role for establishing funding and securing future exerciser development & refinement.

In short, stakeholders concluded that U.S. DOT could provide greater value to the industry by helping to fund a more comprehensive collection of development, testing, deployment, and outreach activities for a smaller and more focused selection of standards. U.S. DOT would be wise to continue consulting with a broad cross section of stakeholders on the choice of standards and the collection of activities.

## Appendix 1 - Participants in this Study

Participant	Planning	Brainstorming Session	Study Reviewer
<b>State and Local Public Sector</b>			
Phil deCabooter, Wisconsin DOT		✓	✓
Al Kosik, Texas DOT	✓	✓	✓
Joel Markowitz, Bay Area MPC			✓
JR Robinson, Virginia DOT		✓	✓
Ed Seymour, Texas Transportation Institute	✓		✓
Bo Strickland, AASHTO	✓		✓
Jim Wright, Minnesota DOT		✓	✓
<b>Technology Manufacturers / Vendors</b>			
Gary Duncan, Econolite	✓		✓
Mark Hudgins, Eagle Traffic Control		✓	✓
Dick Schnacke, Amtech/TransCore		✓	✓
<b>System Integrators</b>			
Steve Dellenback, SW Research Institute		✓	✓
Jeffrey Hochmuth, Iteris			✓
Raman Patel, Parsons Brinkerhoff			✓
Robert Rausch, TransCore		✓	✓
Ken Vaughn, Trevilon Corp.		✓	✓
John Wintermute, PB Farradyne			✓
<b>Standards/Architecture Experts</b>			
Gary Carver, Jet Propulsion Laboratory		✓	✓
Richard Cox, SAE International	✓	✓	✓
Rob Jaffe, Jaffe Engineering			✓
Allan Kirson, Fleetpath LLC			✓
Michael McGurrin, Mitretek Systems		✓	✓
Phil Tarnoff, Univ. of Maryland		✓	✓
Virginia Williams, CEA		✓	✓
<b>ITS America Staff and Consultants</b>			
Dawn Hardesty	✓	✓	✓
Paul Najarian			✓
Richard Weiland	✓	✓	✓
<b>U.S. DOT ITS Joint Program Office</b>			
William Jones	✓	✓	✓
Michael Schagrin	✓	✓	✓



